Table XX. Summary of Inhalation Exposure Concentrations for Automotive Brake Repair and Replacement, and Gasket Replacement (Surrogate Data for DIY Scenario)

Location/Setting	Vehicle Type	Sampling Date	Brief Monitoring Activity Description	N (#ND)	Duration (min)	Asbestos (fibers/cc) PCM analysis (NIOSH Method 7400)		HERO ID; Reference (Data Quality Score)
						Range	Central Tendency	
Brake Repair and Replacement: Personal Breathing Zone								
United States/ Former automobile repair facility; filtered exhaust fan unit used for ventilation. All tests were performed with all seven building outside overhead doors closed.	Automobiles (Chevrolet Impalas) from the 1960s with 4 wheel drum brakes.	July to October 2001	Use of compressed air during removal and replacement of asbestos brake shoes No additional manipulation of the brake shoes.	1 test run	92	--	0.0217 (mean)[a]	3080338; Blake, C. L.,Van Orden, D. R.,Banasik, M.,Harbison, R. D. (2003). Airborne asbestos concentration from brake changing does not exceed permissible exposure limit Regulatory Toxicology and Pharmacology, 38(1), 58-70 (Medium)
				1 test run	85	--	0.0672 (mean)	
		July to October 2001	Use of compressed air during removal and replacement of asbestos brake shoes. Includes filing brakes.	1 test run	102	--	0.0376 (mean)	
			Use of compressed air during removal and replacement of asbestos brake shoes. Includes hand sanding brakes.	1 test run	95	--	0.0776 (mean)	
			Use of compressed air during removal and replacement of asbestos brake shoes. Includes arc grinding brakes.	1 test run	103	--	0.4368 (mean)	
				1 test run	96	--	0.2005 (mean)	
		July 2001	Cleaning only after brake repair	1 test run	30	--	0.0146 (mean)	
Australia/ Three service garages for passenger and light commercial vehicles; natural ventilation	Not specified	Not provided (1999 Publication Date)	Drum brake and disk brake replacement with no dust control measures (Site A); using aerosol spray for dust control (Site B); and	3 (3)	77 - 135	All ND (<0.05)	ND (<0.05)	3080975; Yeung, P.,Patience, K.,Apthorpe, L.,Willcocks, D. (1999). An Australian study to evaluate worker exposure to chrysotile in

Location/Setting	Vehicle Type	Sampling Date	Brief Monitoring Activity Description	N (#ND)	Duration (min)	Asbestos (fibers/cc) PCM analysis (NIOSH Method 7400)		HERO ID; Reference (Data Quality Score)
						Range	Central Tendency	
			using a squirt bottle and compressed air drying for dust control (Site C)					the automotive service industry Applied Occupational and Environmental Hygiene, 14(7), 448-457 (Medium)
Iran/ Thirty brake repair and replacement auto shops	Cars	July-December 2008	Brake repair/replacement, often conducted using a small brush to clean away dust; may include bench grinding.	32	45	0.116-2.48	0.92 ± 2.52 (geometric mean ± geometric standard deviation)	1082293; Kakooei, H.,Hormozy, M.,Marioryad, H. (2011). Evaluation of asbestos exposure during brake repair and replacement Industrial Health, 49(3), 374-380 (Medium)
	Trucks			28		0.117-1.93	0.46 ± 2.57 (geometric mean ± geometric standard deviation)	
Brake Repair and Replacement: Stationary Area Air Sampling								
United States/ Former automobile repair facility; filtered exhaust fan unit used for ventilation. All tests were performed with all seven building outside overhead doors closed.	Automobiles (Chevrolet Impalas) from the 1960s with 4 wheel drum brakes.	July 2001	Use of compressed air during removal and replacement of asbestos brake shoes. No additional manipulation of the brake shoes.	2 test runs ≤3 m from automobile	Not Reported	--	0.00027-0.0258 (mean)	3080338; Blake, C. L.,Van Orden, D. R.,Banasik, M.,Harbison, R. D. (2003). Airborne asbestos concentration from brake changing does not exceed permissible exposure limit Regulatory Toxicology and Pharmacology, 38(1), 58-70 (Medium)
			Use of compressed air during removal and replacement of asbestos brake shoes. Includes filing brakes.	1 test run ≤3 m from automobile	Not reported	--	0.0282 (mean)	
				1 test run >3 m from automobile		--	0.0300 (mean)	

Location/Setting	Vehicle Type	Sampling Date	Brief Monitoring Activity Description	N (#ND)	Duration (min)	Asbestos (fibers/cc)		HERO ID; Reference (Data Quality Score)
						PCM analysis (NIOSH Method 7400)		
						Range	Central Tendency	
			Use of compressed air during removal and replacement of asbestos brake shoes. Includes hand sanding brakes.	1 test run ≤3 m from automobile	Not reported	--	0.0133 (mean)	
				1 test run >3 m from automobile		--	0.0112 (mean)	
				1 test run at work bench used for sanding		--	0.0142 (mean)	
			Use of compressed air during removal and replacement of asbestos brake shoes. Includes arc grinding brakes.	2 test runs ≤3 m from automobile	Not reported	--	0.0276-0.0296 (mean)	
				2 test runs >3 m from automobile		--	0.0265-0.0389 (mean)	
				2 test runs at work bench used for grinding		--	0.0450-0.0895 (mean)	
	Automobiles (Chevrolet Impalas) from the 1960s with 4 wheel drum brakes	July 2001	Cleaning only after brake repair	1 test run ≤3 m from automobile	Not reported	--	0.0069 (mean)	3080338; Blake, C. L.,Van Orden, D. R.,Banasik, M.,Harbison, R. D. (2003). Airborne asbestos concentration from brake changing does not exceed permissible exposure limit Regulatory Toxicology and Pharmacology, 38(1), 58-70 (Medium)
				1 test run >3 m from automobile		--	0.0071 (mean)	
				1 test run at work bench used for filing, sanding, grinding		--	0 (mean)	
Automobile Gasket Repair and Replacement: Personal Breathing Zone								

Location/Setting	Vehicle Type	Sampling Date	Brief Monitoring Activity Description	N (#ND)	Duration (min)	Asbestos (fibers/cc)		HERO ID; Reference (Data Quality Score)
						PCM analysis (NIOSH Method 7400)		
						Range	Central Tendency	
United States/ Operative automotive repair facility performing engine disassembly and reassembly, gasket manipulation and parts cleaning.	Automobiles - 1974 Chevrolet Malibu, 1978 Chevrolet pickup truck and a Ford 390 cubic inch V-8 engine	Not provided (2006 Publication Date)	Engine disassembly - gaskets removed	3 test sessions	60-141	ND (0.007)-0.027	--	3520458; Blake CL, Dotson GS, et al. (2006). Assessment of airborne asbestos exposure during the servicing and handling of automobile asbestos-containing gaskets. Regul Toxicol Pharmacol 45:214–222 (Medium)
			Engine reassembly - gaskets installed	2 test sessions	151-156	ND (0.005)-0.0058	--	
United States/ Independent repair facility; the disassembly and related work was conducted in an open shop.	The engine utilized for this study was a mid-sized, turbocharged, six-cylinder, in-line unit, built in 1982	2005 (pub. Date)	Complete disassembly and cleaning of a medium duty diesel engine by a journeyman mechanic. Asbestos content of gaskets reported.	14 (NR)	25-103	0.017-<0.120	--	3531131; Liukonen LR, Weir FW. (2005). Asbestos exposure from gaskets during disassembly of a medium duty diesel engine. Regul Toxicol Pharmacol 41:113–121. (Medium)

Location/Setting	Vehicle Type	Sampling Date	Brief Monitoring Activity Description	N (#ND)	Duration (min)	Asbestos (fibers/cc)		HERO ID; Reference (Data Quality Score)
						PCM analysis (NIOSH Method 7400)		
						Range	Central Tendency	
United States/ Muffler shop specializing in automobile exhaust repair and custom work for current, as well as vintage automobiles. All service bay doors were closed; the muffler shop was not equipped with any heating, air conditioning, or ventilation systems.	Automobiles (ca. 1945–1975)	January and July 2004	Removal of automobile exhaust systems (ca. 1945–1975) containing asbestos gaskets. In most cases, the mechanic removed most or all of the gaskets with his fingers or by prying them off with a screwdriver. Any residual gasket material left behind was scraped off with the screwdriver or pulled off by hand	23 (17)	9-65	0.006-0.066	0.022 (mean)	3531296; Paustenbach, D. J.,Madl, A. K.,Donovan, E.,Clark, K.,Fehling, K.,Lee, T. C. (2006). Chrysotile asbestos exposure associated with removal of automobile exhaust systems (ca. 1945-1975) by mechanics: results of a simulation study Journal of Exposure Science and Environmental Epidemiology, 16(2), 156-171 (High)

[a] Average fiber concentration during each duration.

Commented [CT1]: Changed max value in text b/c the 0.132 fibers/cc were extracted from Table 3 which are sensitivity limits not concentrations. Concentrations are reported in Table 2.

Commented [CT2]: Nate scored high and Laura scored medium.